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J. P. DONMOYER, INC.
ONO, PENNSYLVANIA

BULK INVENTORY NETWORK SYSTEM

ENGINEERING REPORT
APRIL 13, 1998

STEVEN G. LOWRY & ASSOCIATES, INC.
MECHANICSBURG, PENNSYLVANIA

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April 13, 1998

Mr. David Wallace
Director, Sales and Marketing
J. P. Donmoyer, Inc.
P.O. Box 74
Ono, PA 17077

RE: Engineering Report -- Instrumentation for Bulk Inventory Network System

Dear Dave:

Enclosed are three copies of the Engineering Report relating to J. P. Donmoyer's Bulk Inventory Network System. This report provides an evaluation of control concepts and alternative manufacturer equipment and instrumentation for the BINS system. The report has been finalized based on comments received during our review meeting on April 8, 1998.

If you would like to discuss the report or its findings, please contact me. I am available to meet with you at your convenience.

If you have questions, please do not hesitate to call.

Very truly yours,

STEVEN G. LOWRY & ASSOCIATES, INC.

Steven G. Lowry

Steven G. Lowry, P.E.

cc: Mr. Frank Costanzo, w/enclosures
Mr. Michael Egbert, w/enclosures

J. P. DONMOYER, INC.
BULK INVENTORY NETWORK SYSTEM

ENGINEERING REPORT

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INTRODUCTION

J. P. Donmoyer, Inc. uses a Bulk Inventory Network System (BINS) to monitor customer inventories and order delivery of materials. The BINS system depends on transmission of data from remote customer sites to a computer in the J. P. Donmoyer (JPD) office. Information, transferred by telephone communications, consists of the level or weight of material in storage at the customer's business. When a trigger level or volume is reached, dispatchers are notified that a shipment should be delivered. Customer storage records are monitored on the BINS central computer and displayed on a trend graph. The current amount and the rate of consumption of material can be observed.

The purposes of this report are to evaluate alternative telemetry methods and equipment that can be used to transmit data from the customer sites, receive it, and display it on JPD's central computer. Costs associated with each alternative are presented and recommendations are provided based on advantages, disadvantages and costs.

EXISTING SYSTEM

The existing system consists of a central computer and modem at JPD's office, and a remote telemetry unit (RTU), modem and weight or level sensor/transmitter at the customer site. This equipment was supplied by Magyar & Associates, and installed by Tri-Star, Inc. A schematic of the existing system is shown on Figure 1.

LOOKOUT software is installed and continuously running on the central computer. This Man-Machine Interface (MMI) software receives and stores data transmitted from the RTUs at each customer site. The software is programmed to display the information on a trend graph. The LOOKOUT software currently on JPD's computer is the "Run-Time" version of the program. This "Run-Time" version does not allow JPD personnel to modify or add LOOKOUT displays. Therefore, if changes or additions are desired when new customers are brought on-line, an outside firm using the "Development" version of LOOKOUT must perform the necessary programming.

The functions of the customer site equipment are to measure the level or weight of material in storage, call the central computer at JPD's office, and transfer the data into the LOOKOUT MMI software.

A Kistler-Morse ultrasonic level transmitter or strain gage is used to measure stored material. These devices typically produce a signal in the range of 4 to 20 mA proportional to material volume. The RTU receives the 4-20 mA signal and converts it into the corresponding level or weight of material. The RTU also places telephone calls, on pre-set two hour timed intervals, to JPD's computer and transfers its reading. The power supply to the RTU is 120 VAC.

The telephone connection is accomplished through modems in the RTU and JPD's central computer. If the line is in use at JPD, the RTU will redial until it establishes a connection and transmits its data. The RTU will make up to 99 repeated attempts to communicate with the central computer.

A remote telemetry unit is currently installed at the Bethlehem Steel Plant in Steelton. A second customer site is proposed for the NuCor Plant, located in Darlington, South Carolina. Additional customer sites are projected to be activated in the future.

TELEMETRY ALTERNATIVES

The general concept of a central computer at JPD's office that receives data from the customer sites and maintains material storage records is common to each telemetry alternative presented in this evaluation. The optimum system should (1) require little time and effort to install, (2) be simple to operate and allow for system programming modifications, (3) require a minimum amount of maintenance, (4) be easy to order from the manufacturer, and (5) have reasonable cost. Alternatives associated with the JPD BINS system involve communication control, the level of processing required at the central versus the remote sites, equipment manufacturer, and costs. These are grouped into the categories of control concept alternatives and manufacturer alternatives.

Control Concept Alternatives

Remote Control

A remotely controlled system involves a microprocessor based RTU, programmed to input a signal from the weight/level sensing device, place a telephone call to the central computer, and transfer data to the computer. The existing JPD BINS system monitoring the material volume at Bethlehem Steel in Steelton is remotely controlled.

The RTU controls data collection and transmission, and therefore requires relatively sophisticated programming. RTUs are usually configured using a laptop computer connected directly to a port in the RTU. Due to their complex functional capabilities, these RTUs typically are relatively expensive.

Under the remote control concept, the central computer acts primarily as a data storage and display device. The computer would be a standard personal computer. Changes to system operations, such as time intervals between data transmissions, could require a trip to the customer site to modify RTU programming.

Central Control

A centrally controlled system consists of a main computer that contacts each remote unit and retrieves data from that RTU. Customer site equipment includes a basic RTU configured to input a signal from the level/weight sensing device, and on command, transfer that data to the central computer. System configuration changes would be programmed at the central computer site and, once in operation, modifications at the RTUs should not be necessary.

System control and programming is concentrated at the central computer. However, standard control software and computer hardware capabilities are such that costs should not increase compared to a remote controlled system. The computer would be a standard personal computer. RTUs would act primarily as data collection devices and, as a result, RTU programming would be minimized.

Under a central control system, the RTUs require less processing capability. Consequently, installation, start-up and maintenance are less difficult, and costs usually are lower than for more complicated RTUs as needed in a remote controlled system. Customer site installation may involve no more than "plugging-in" the RTU to 120 VAC power and attaching the telephone line and the wire from the level/weight sensor to the RTU.

Telephone calls would be initiated by the central computer, such that the computer controls data transmission. This eliminates overlap in RTU telephone calls. However, a separate telephone line will be required for each customer site RTU. Central control of data transmission will become more important as more customers are brought on-line.

Summary

The advantage associated with a remote controlled system is the ability to use existing telephone lines, such that a separate RTU line probably will not be necessary. The advantages associated with a central controlled system include easier installation and start-up, less maintenance, central control of data transmission, central programming capability, and lower cost.

Manufacturer Alternatives

The JPD BINS telemetry application requires standard "off-the-shelf" instrumentation, and many suppliers and manufacturers provide this type of equipment. Quotes were obtained from three suppliers, as follows:

1. Magyar & Associates -- Control Microsystems products
2. Bristol Babcock, Inc.
3. Proconex -- Fisher-Rosemount products

The existing BINS telemetry hardware and software were supplied by Magyar & Associates. There are advantages associated with continuing to use LOOKOUT software and upgrading the BINS system, instead of replacing it. If upgraded, the data and

displays in the existing system could be transferred directly into the enhanced software, and not require translation to a new system.

The supplier quotes include all hardware and software required for the JPD BINS application, although it was assumed the existing central computer would be reused and reprogrammed, as necessary. The quotes do not include the level/weight sensing device, and do not include installation and start-up costs. Copies of the supplier and manufacturer submissions, and related product information is provided in the Appendices. A description of hardware, software and costs follows:

Magyar & Associates -- Control Microsystems

Central Control Station: Upgrade central computer software from the LOOKOUT "Run-Time" to a LOOKOUT "Development" version, configured for 100 Input/Output signals. Based on current data transmissions, this software would handle 100 customer sites.

Remote Customer Sites: Provide Control Microsystems Smartwire modules for processing communications, analog input, power supply and a modem. Up to eight analog signals (customer material volumes) can be input to each RTU. The RTU power supply would be 120 VAC. A separate telephone line would need to be connected to the modem in the RTU. The modules would be enclosed in a water tight Nema 4 cabinet.

Cost:	Hardware and Software -- Central Control Station	$ 3,100
	Hardware and Software -- Per RTU	$ 1,900

Costs represent equipment cost only, and do not include installation.

Bristol Babcock, Inc.

Central Control Station: Replace the LOOKOUT "Run-Time" software with Bristol's ZxMMI Graphics software. Bristol's system architecture also requires a separate RTU 3305 data collector module, with communication software and modem, at the central control station. The ZxMMI software will handle more than 1000 customer sites.

Remote Customer Sites: Provide Bristol Babcock's model RTU 3301 module, with power supply and modem, packaged in a Nema 4 enclosure. The model 3301 unit allows one analog input signal. The RTU power supply would be 120 VAC. A separate telephone line would need to be connected to the modem in the RTU.

Cost:	Hardware and Software -- Central Control Station	$ 6,300
	Hardware and Software -- Per RTU	$ 1,800

Costs represent equipment cost only, and do not include installation.

Proconex -- Fisher-Rosemount

Central Control Station: Replace the LOOKOUT "Run-Time" software with Intellution FIX MMI graphics software, configured for 75 Input/Output points. Based on current data transmissions, this software would handle 75 customer sites.

Remote Customer Sites: Provide Fisher-Rosemount ROC 306 controller, with power supply, modem, and ROCPAC controller software drivers. The ROCPAC unit will handle three analog inputs, two digital inputs, and two digital outputs. The modules would be contained in a water tight Nema 4 enclosure. The RTU power supply would be 120 VAC. A separate telephone line would need to be connected to the modem.

Cost:	Hardware and Software -- Central Control Station	$ 2,200
	Hardware and Software -- Per RTU	$ 2,500

Costs represent equipment cost only, and do not include installation.

Summary

The advantages associated with Magyar & Associates -- Control Microsystems include:

1. Lowest combined costs for the central control station and each RTU.
2. The upgraded system would be compatible with the existing BINS at Bethlehem Steel in Steelton and the proposed BINS at NuCor in South Carolina.
3. Eight analog inputs per RTU provides expansion capability at each customer site.

The advantages associated with Bristol Babcock, Inc. include:

1. Lowest costs per RTU.
2. The ZxMMI graphics software can accommodate several thousand input/output signals.

The advantages associated with Proconex – Fisher-Rosemount include:

1. Lowest cost for the central control station.
2. There is expansion capability at each customer site, including control functions, based on three analog inputs, two digital inputs and two digital outputs per RTU.

CONCLUSIONS AND RECOMMENDATIONS

1. The optimum system configuration for JPD is to concentrate command functions, programming and communication control at the central computer in JPD's office. This arrangement allows JPD staff to modify and update their system without reprogramming remotes, and should reduce overall costs. The basic RTUs utilized in a centralized system also should be easier to install and should require less maintenance than the more complex RTUs used in a remote control type system.

2. The central control concept corresponds to the optimum system configuration, and provides advantages relative to the remote control option. It is important that JPD staff have the capability to upgrade, modify and add system displays at the central control station.

3. JPD should convert their BINS application from a remote control system to a central control system.

4. JPD should proceed with the purchase of LOOKOUT "Development" software, from Magyar & Associates. This software will be used to implement the central control configuration of the system, and to prepare the displays for the NuCor

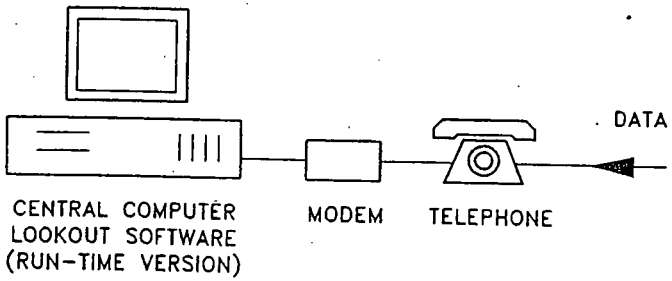
material volume. Advance planning could be made for future customer sites. The "Development" version of the software will become increasingly important as more customer sites are activated and more displays are needed.

5. Remote site equipment should be Control Microsystems products and Kistler-Morse transmitters, as supplied by Magyar & Associates. This alternative provides the lowest combined costs and has advantages associated with compatibility with the existing BINS data.

6. A complete purchase document or specifications should be prepared that defines equipment functions, delivery schedules, installation requirements, user manuals, wiring diagrams, factory testing and equipment warranties. This document would be used when purchasing customer site instrumentation.

7. Depending on site conditions, JPD should consider performing installation of customer RTUs.

DONMOYER OFFICE
CENTRAL CONTROL STATION



TYPICAL CUSTOMER SITE

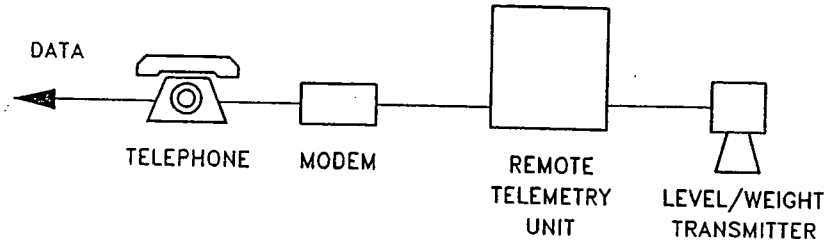


FIGURE 1